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United States Patent [19]**Thundat et al.**[11] **Patent Number:** **5,719,324**[45] **Date of Patent:** **Feb. 17, 1998**[54] **MICROCANTILEVER SENSOR**[75] **Inventors:** Thomas G. Thundat, Knoxville; Eric A. Wachter, Oak Ridge, both of Tenn.[73] **Assignee:** Lockheed Martin Energy Systems, Inc., Oak Ridge, Tenn.[21] **Appl. No.:** 491,203[22] **Filed:** Jun. 16, 1995[51] **Int. Cl.⁶** G01N 27/00[52] **U.S. Cl.** 73/24.01; 73/24.06; 422/88[58] **Field of Search** 73/24.01, 24.04, 73/24.06, 24.05; 422/88, 91, 83; 310/312, 321, 330, 331[56] **References Cited****U.S. PATENT DOCUMENTS**

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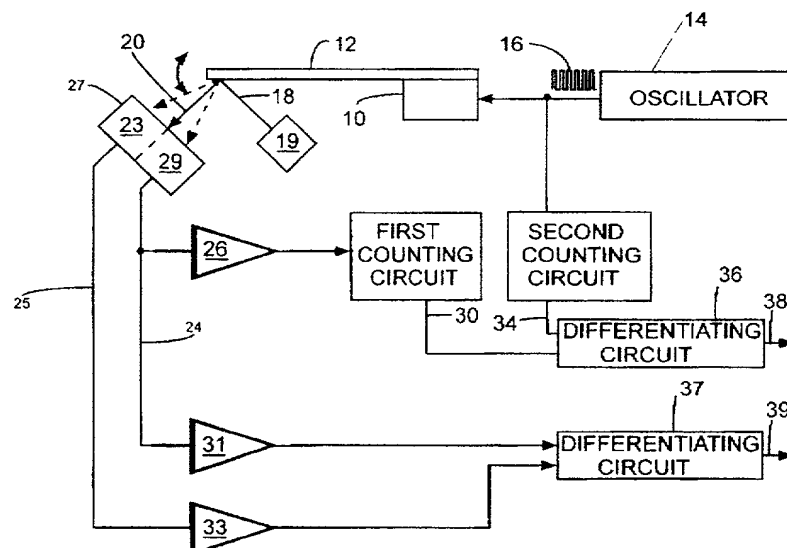
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An improved microcantilever sensor is fabricated with at least one microcantilever attached to a piezoelectric transducer. The microcantilever is partially surface treated with a compound selective substance having substantially exclusive affinity for a targeted compound in a monitored atmosphere. The microcantilever sensor is also provided with a frequency detection means and a bending detection means. The frequency detection means is capable of detecting changes in the resonance frequency of the vibrated microcantilever in the monitored atmosphere. The bending detection means is capable of detecting changes in the bending of the vibrated microcantilever in the monitored atmosphere coactively with the frequency detection means. The piezoelectric transducer is excited by an oscillator means which provides a signal driving the transducer at a resonance frequency inducing a predetermined order of resonance on the partially treated microcantilever. Upon insertion into a monitored atmosphere, molecules of the targeted chemical attach to the treated regions of the microcantilever resulting in a change in oscillating mass as well as a change in microcantilever spring constant thereby influencing the resonant frequency of the microcantilever oscillation. Furthermore, the molecular attachment of the target chemical to the treated regions induce areas of mechanical strain in the microcantilever consistent with the treated regions thereby influencing microcantilever bending. The rate at which the treated microcantilever accumulates the target chemical is a function of the target chemical concentration. Consequently, the extent of microcantilever oscillation frequency change and bending is related to the concentration of target chemical within the monitored atmosphere.

32 Claims, 6 Drawing Sheets

ABSTRACT OF THE DISCLOSURE

CHEMICAL OR BIOLOGICAL ANALYSIS PLATFORM WITH MICRO-
BALANCES, DEVICE AND ANALYSIS PROCESS USING THE
PLATFORM

Biological or chemical analysis platform (102) comprising at least one fixed support (110) and at least one first mobile support (104a) that can be coated with a reagent, the mobile support being
5 connected to the fixed support by flexible support means (108a) that may be deflected in response to a change in a weight supported by the first mobile support, caused by a chemical or biological reaction of the said reagent.

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Figure 1.